CONTAINER SYSTEM FOR TRANSPORTING AND STORING HIGHLY RADIOACTIVE MATERIALS

Patent Claims:

1. A container system for transporting and storing highly radioactive materials, characterized in that it comprises an outer container (1) holding at least one inner container (2) that itself holds the radioactive material.

2. The container system according to claim 1, characterized in that the inner container (2) is supported by springs in the outer container (1).

3. The container system according to claim 1 or 2, characterized in that the outer container is comprised of a cylinder (4) having a side wall (4) of reinforces prestressed spun concrete with for example boron oxide as an additional neutron absorber.

4. The container system according to claims 1 to 3, characterized in that the outer container has a cover (6) and a floor (7) that are made of reinforced concrete with the addition of for example boron oxide as an additional neutron absorber.

5. The container system according to claim 4 characterized in that the cover (6) and the floor (7) are made of prestressed reinforced spun concrete with the addition of for example boron oxide as an additional neutron absorber.

6. The container system according to claims 1 to 5 that springs (10 and 11) bear against an inner surface (9) of the side wall (5), of the cover (6), and of the floor (7).

7. The container system according to claims 1 to 6, characterized in that the springs (10 and 11) are provided with shock absorbers.

8. The container system according to claims 1 to 7, characterized in that the springs (11) bearing on the cover (6) and the floor (7) have a long spring travel and a high spring constant.

9. The container system according to claims 1 to 8, characterized in that the springs (10) bearing on the side wall (5) have a short spring travel and a low spring constant.

10. The container system according to claims 1 to 9, characterized in that springs (10) bearing on the side wall (5) are distributed rotation symmetrically about its inner surface (9).

11. The container system according to claims 1 to 10, characterized in that a plurality of the springs (10) are distributed in a row longitudinally of the side wall (5).

12. The container system according to claims 1 to 11, characterized in that each spring (10 and 11) is provided with a prestressing device that prestresses it outwardly toward the outer container (1).

13. The container system according to claim 1 to 12, characterized in that the prestressing devices are threaded bolts that extend through the side wall (5), the cover (6) and the floor (7) and engage with an internal thread in a bracing washer that the springs (10 and 11) bear inward on.

14. The container system according to claims 1 to 13, characterized in that the inner container (2) is generally completely enclosed in an intermediate container (3) having a side wall (12), a cover (13) and a floor (14) against which the springs (10 and 11) are braced.

15. The container system according to claims 1 to 14, characterized in that the side wall (12) of the intermediate container (3) is made of prestressed reinforced spun concrete with the addition of for example boron oxide as an additional neutron absorber.

16. The container system according to claim 1 to 15 characterized in that the cover (13) and the floor (14) of the intermediate container (3) is made of reinforced concrete with the addition of for example boron oxide as an additional neutron absorber.

17. The container system according to claim 1 to 15 characterized in that the cover (13) and the floor (14) of the intermediate container (3) is made of prestressed reinforced spun concrete with the addition of for example boron oxide as an additional neutron absorber.

18. The container system according to claims 1 to 17, side-wall, cover, and floor inner surfaces (15, 16, and 17) of the intermediate container (3) have respective polyethylene layers (18, 19, and 20) for moderating neutrons generated by the radioactive material inside the inner container (2).

19. The container system according to claims 1 to 18, characterized in that the inner container (2) is double-walled and has between the inner wall (21) and outer wall (22) of its side wall (23), of its cover (24), and of its floor (25) spaces (26, 27, and 28) a gamma- and neutron-ray absorber (29).

20. The container system according to claims 1 to 19, characterized in that the absorber (29) generally fully surrounds an inner chamber (30) of the inner container (2).

21. The container system according to claims 1 to 20, characterized in that the absorber is comprised of depleted uranium (uranium oxide) or a similarly effective material.

22. The container system according to claims 1 to 21, characterized in that the inner container is comprised of stainless steel with contamination-reducing smooth surfaces.

23. The container system according to claims 1 to 22, characterized in that the inner container (2) has on an upper surface of its cover (24) an annular flange (24) that projects outward from the inner container (2) and that is of the same outer diameter as an outer surface of the side wall (12) of the intermediate container (3).

24. The container system according to claims 1 to 23, characterized in that the inner container (2) has a mounting ring (37) closing an annular gap between the inside wall (21) and the outer wall (22) at the annular flange (34) and formed with threaded bores (38) receiving mounting bolts (39) that traverse and secure the cover (24) of the inner container (2).

25. The container system according to claims 1 to 24, characterized in that above the cover (24) of the inner container (2) there is an intermediate cover (40) that is secured by threaded bolts (41) to the annular flange (34) and that is covered on its lower face (42) by a layer of polyethylene (13).

26. The container system according to claims 1 to 25, characterized in that the side walls (5 and 12), the covers (6 and 13), and the floors (7 and 14) of the outer container (1) and of the intermediate container (3) pare provided with longitudinally throughgoing tubes (43 and 44) in which are provided mounting elements (45 and 46) for prestressing and closing the outer container (1) and the intermediate container (3).

27. The container system according to claims 1 to 26, characterized in that the mounting elements (45 and 46) are tie rods.

28. The container system according to claims 1 to 27, characterized in that the outer containers (1) is provided adjacent its floor (7) with a plurality of air-inlet openings (47) and near its cover (6) with a plurality of air-outlet openings (48) distributed radially symmetrically over the side wall (5).

29. The container system according to claims 1 to 28, characterized in that the air-inlet openings (47) and the air-outlet openings (48) are closable.

30. The container system according to claims 1 to 13 and 27 to 29, characterized in that the inner container (2) contained in the outer container (1) is a standard Castor cask (49).